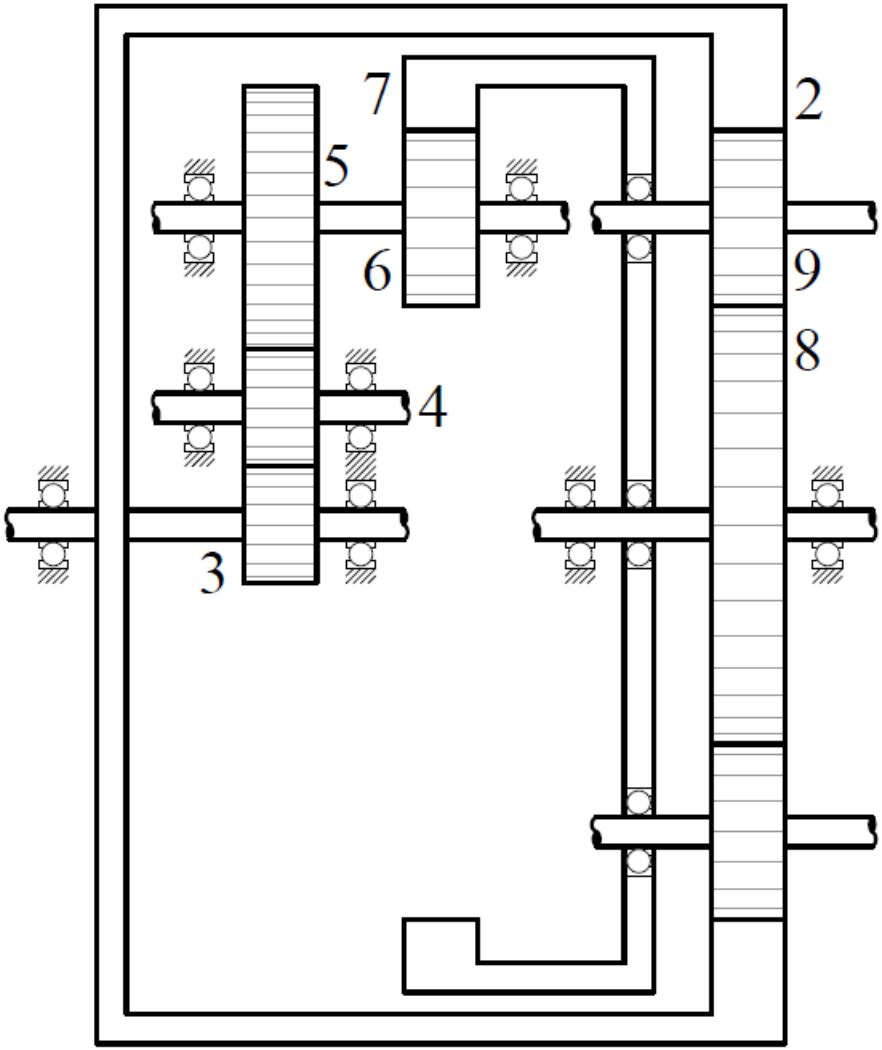
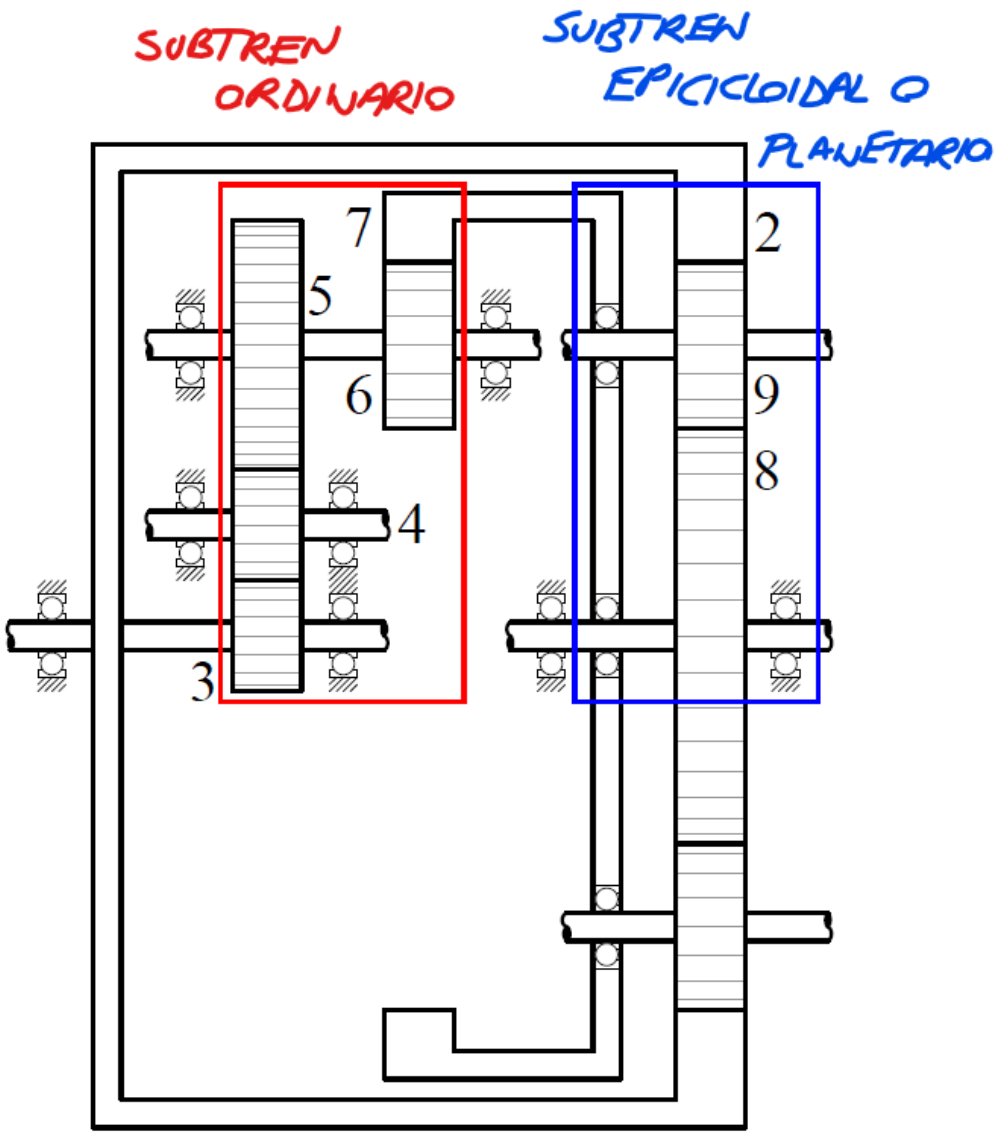
EJERCICIO 1

$$\omega_8 = f(\omega_3)$$




SUBTREN ORDINARIO
SUBTREN EPICICLOIDAL O PLANETARIO
7
5
6
4
3
2
9
8

ECUACIÓN GENERAL $\Rightarrow$ $\dfrac{w_i - w_R}{w_j - w_R} = \dfrac{w_{iR}}{w_{jR}}$

SUBTREN PLANETARIO O EPICICLOIDAL

2 - 9 - 8 - BRAZO 7

$$\frac{w_2 - w_7}{w_8 - w_7} = \frac{w_{27}}{w_{87}} = \frac{w_{27}}{w_{97}} \cdot \frac{w_{97}}{w_{87}} = \left(\frac{z_9}{z_2}\right)\left(-\frac{z_8}{z_9}\right) = -\frac{z_8}{z_2} \; *$$

SUBTREN ORDINARIO COMPUESTO

3 - 4 - 5 - 6

$$\frac{w_3 - 0}{w_6 - 0} = \frac{w_3}{w_6} = \frac{w_3}{w_4} \cdot \frac{w_4}{w_5} \cdot \frac{w_5}{w_6} = \left(-\frac{z_4}{z_3}\right)\left(-\frac{z_5}{z_4}\right) \cdot 1 = \frac{z_5}{z_3} \; *$$

ECUACIONES DE LIGADURA O DE ENLACE ENTRE TRENES

$w_2 = w_3$ *

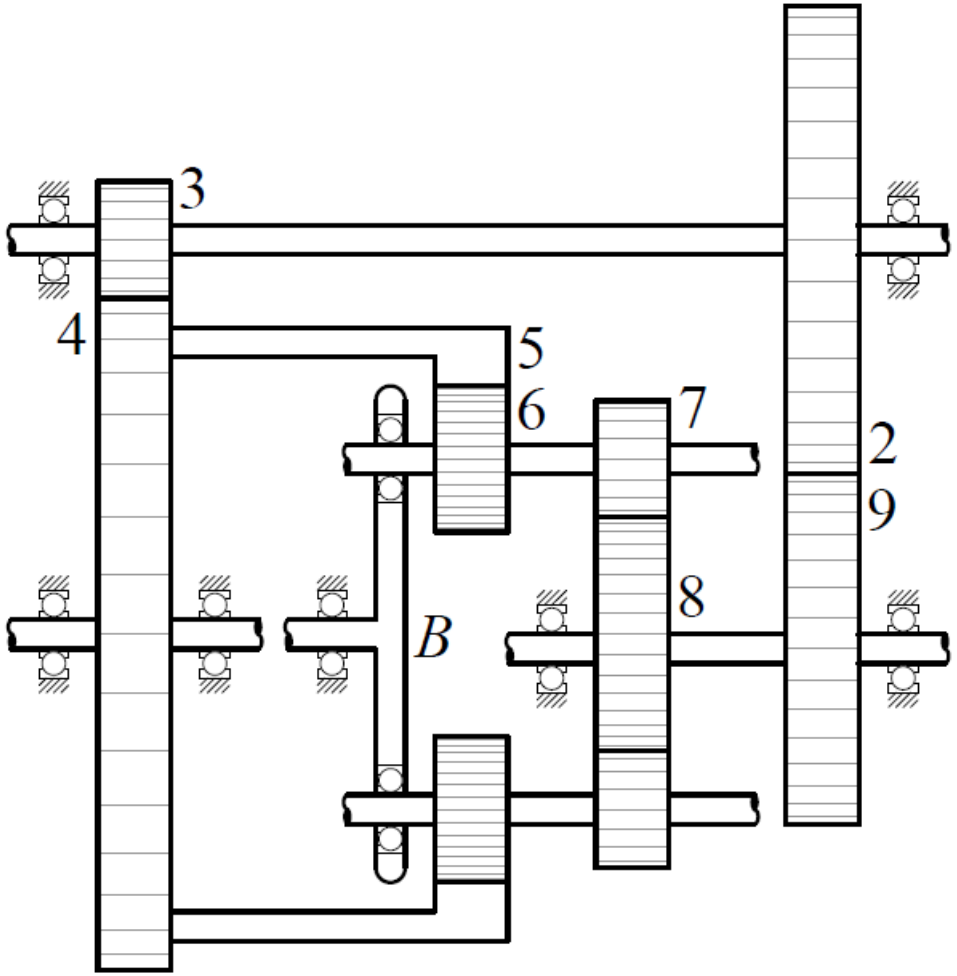
$\dfrac{w_6}{w_7} = -\dfrac{z_7}{z_6}$ *

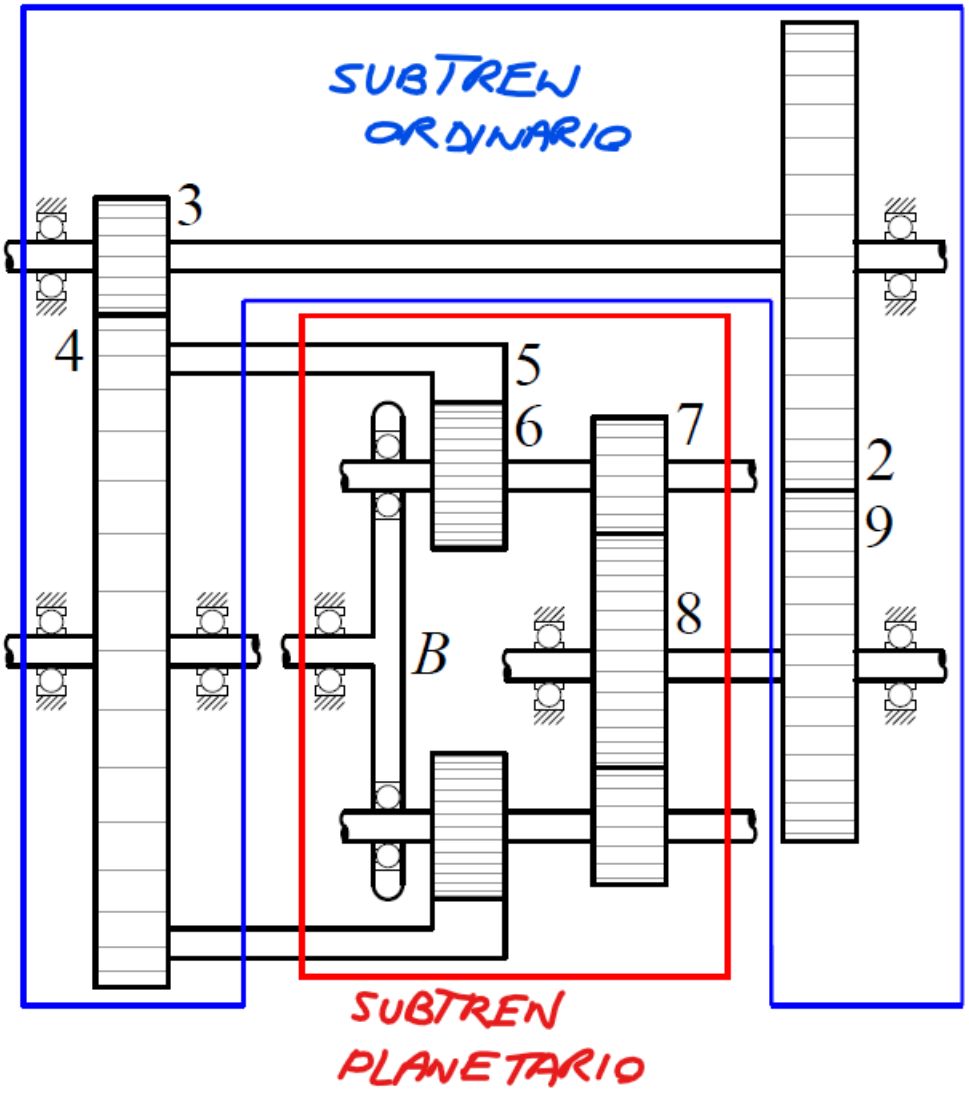
4 ecuaciones * / 4 incógnitas O? } sistema que se puede resolver

$$w_8 = w_3 \left(\frac{z_6 z_3}{z_7 z_5} + \frac{z_9 z_6 z_3}{z_8 z_7 z_5} - \frac{z_9}{z_8}\right)$$

EJERCICIO 2

$$\omega_B = f(\omega_9)$$




SUBTREN
ORDINARIO
3
4
5
6
7
2
9
8
B
SUBTREN
PLANETARIO

ω_9 ✓ ω_B ?

TREN ORDINARIO

4 - 3 - 2 - 9

$$\frac{\omega_4 - 0}{\omega_9 - 0} = \frac{\omega_4}{\omega_9} = \frac{\omega_4}{\omega_3} \cdot \frac{\omega_3}{\omega_2} \cdot \frac{\omega_2}{\omega_9} = \left(-\frac{z_3}{z_4}\right) \cdot 1 \cdot \left(-\frac{z_9}{z_2}\right) = \frac{z_3 z_9}{z_4 z_2} \ *$$

TREN PLANETARIO O EPICICLOIDAL

5 - 6 - 7 - 8 - BRAZO B

$$\frac{\omega_5 - \omega_B}{\omega_8 - \omega_B} = \frac{\omega_{5B}}{\omega_{8B}} = \frac{\omega_{5B}}{\omega_{6B}} \cdot \frac{\omega_{6B}}{\omega_{7B}} \cdot \frac{\omega_{7B}}{\omega_{8B}} = \left(\frac{z_6}{z_5}\right) \cdot 1 \cdot \left(-\frac{z_8}{z_7}\right) = -\frac{z_6 z_8}{z_5 z_7} \ *$$

ECUACIONES DE LIGADURA O DE ENLACE

$\omega_4 = \omega_5$ *

$\omega_8 = \omega_9$ *

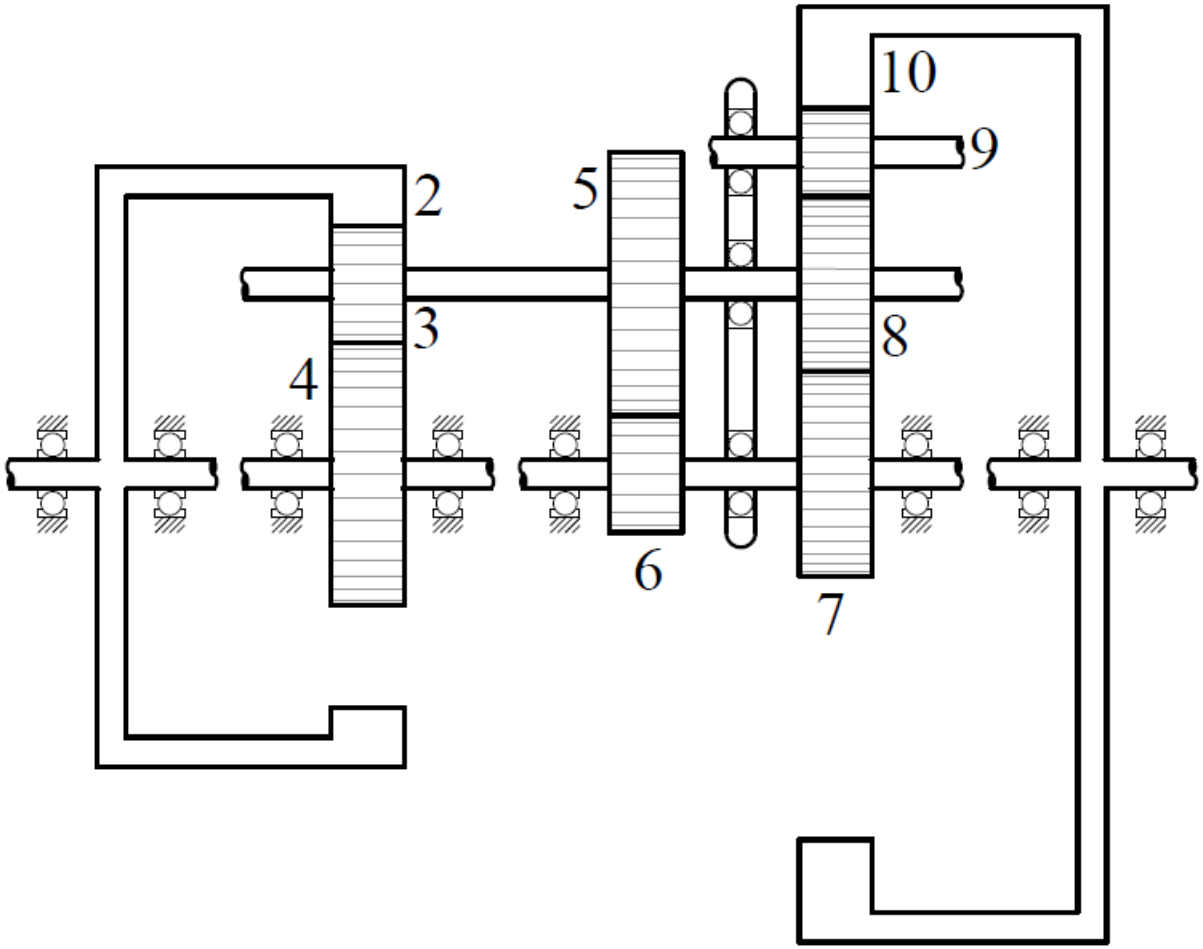
4 ecuaciones y 4 incógnitas ⇒ SISTEMA RESOLUBLE

$$\omega_B = \omega_9 \cdot \frac{\left(\frac{z_6 z_8}{z_5 z_7} - \frac{z_9}{z_2}\right)}{\left(1 + \frac{z_6 z_8}{z_5 z_7}\right)}$$

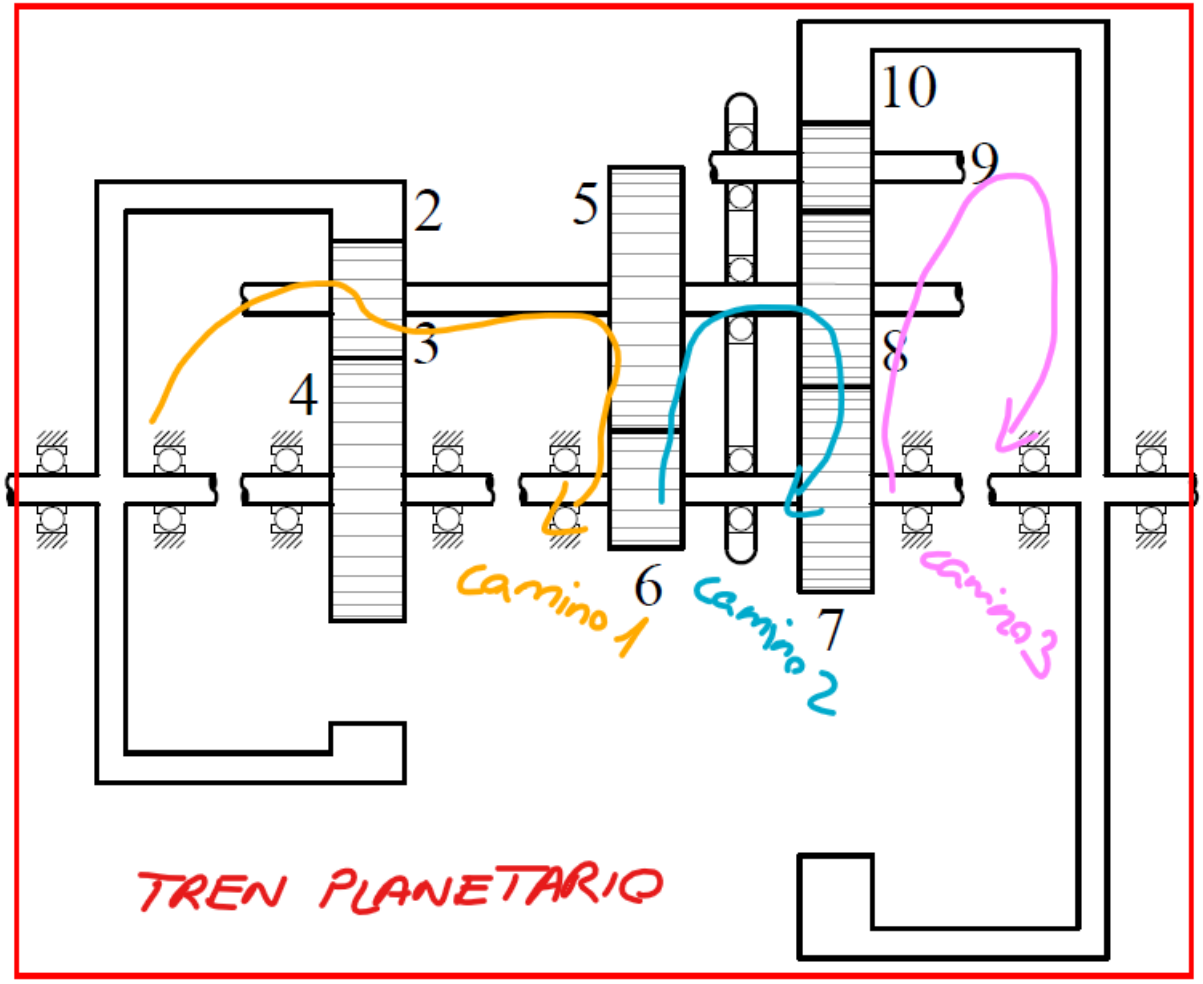
FACTOR DEL TREN

EJERCICIO 3

$$\omega_9 = f\left(\omega_2, \omega_7\right)$$



Este tren planetario tiene un único brazo, dos soles (ruedas dentadas 4, 6 y 8), dos coronas (ruedas dentadas 10 y 2) y varios satélites. En este tren planetario hay tres caminos para recorrer la totalidad de los eslabones o engranajes que lo componen. Los tres caminos se pueden ver como tres subtrenes planetarios y cada subtren tendrá su ecuación de movimiento.



w_2 ✓ w_7 ✓ ¿ w_9 ?

Camino 1 · SUBTREN PLANETARIO 2-3-5-6-BRAZO b

✓ $\frac{w_2 - w_b}{?\ w_6 - w_b} = \frac{w_{2b}}{w_{6b}} = \frac{w_{2b}}{w_{3b}} \cdot \frac{w_{3b}}{w_{5b}} \cdot \frac{w_{5b}}{w_{6b}} = \left(\frac{z_3}{z_2}\right) \cdot 1 \cdot \left(-\frac{z_6}{z_5}\right) = -\frac{z_3 z_6}{z_2 z_5}$ *

Camino 2 · SUBTREN PLANETARIO 6-5-8-7-BRAZO b

✓ $\frac{w_6 - w_b}{w_7 - w_b} = \frac{w_{6b}}{w_{7b}} = \frac{w_{6b}}{w_{5b}} \cdot \frac{w_{5b}}{w_{8b}} \cdot \frac{w_{8b}}{w_{7b}} = \left(-\frac{z_5}{z_6}\right) \cdot 1 \cdot \left(-\frac{z_7}{z_8}\right) = \frac{z_5 z_7}{z_6 z_8}$ *

Camino 3 · SUBTREN PLANETARIO 7-8-9-10-BRAZO b

? $\frac{w_7 - w_b}{w_{10} - w_b} = \frac{w_{7b}}{w_{10b}} = \frac{w_{7b}}{w_{8b}} \cdot \frac{w_{8b}}{w_{9b}} \cdot \frac{w_{9b}}{w_{10b}} = \left(-\frac{z_8}{z_7}\right) \cdot \left(-\frac{z_7}{z_8}\right) \left(\frac{z_{10}}{z_9}\right) = \frac{z_{10}}{z_7}$ *

ECUACIONES DE LIGADURA

$w_6 = w_7$ *

4 ecuaciones y 4 incógnitas ⇒ RESOLUBLE

$$\left.\begin{aligned} \frac{w_2 - w_b}{w_3 - w_b} &= -\frac{z_3 z_6}{z_2 z_5} \\ \frac{w_7 - w_b}{w_{10} - w_b} &= \frac{z_{10}}{z_7} \end{aligned}\right\}$$ 2 ecuaciones y 2 incógnitas: w_b y w_{10}

Se pide $w_9 = f(w_2, w_7) \Rightarrow \frac{w_9 - w_b}{w_3 - w_b} = -\frac{z_7}{z_9} \rightsquigarrow \boxed{w_9}$